PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/047,420

Filing Date: 1/14/2002

Applicant: Tanaya, et al.

Group Art Unit: To be assigned

Examiner: To be assigned

Title: VIBRATING PIECE, VIBRATOR, OSCILLATOR, AND ELECTRONIC DEVICE

Attorney Docket: 9319S-000321

Commissioner of Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to the examination of this application, please amend it as follows.

IN THE SPECIFICATION

Please replace the following paragraphs of the specification. Applicant includes herewith an Attachment for Specification Amendments showing a marked up version of each replacement paragraph.

[0011]   Therefore, as a method of preventing such a situation, there is a method using a CI value ratio as a reference. This CI value ratio is such that the CI value of a harmonic wave is divided by the CI value of a fundamental wave (CI value of

harmonic wave/CI value of fundamental wave).

[0013]   In order to make the CI value ratio 1.0 or more in the manner described above, it is necessary to make the CI value of the harmonic wave greater. As a method therefor, it is known that the length (d1) of the excitation electrodes 12b and 13b formed in the grooves 12a and 13a is made to be half, i.e., 0.5L, with respect to the length (L) of the vibration arm sections 12 and 13 in Fig. 11.

[0014]   Fig. 13 shows the relationship between the CI value of the fundamental wave, such as the above, and the CI value ratio. As shown in Fig. 13, the shorter the length (d1) of the excitation electrodes 12b and 13b becomes with respect to the length (L) of the vibration arm sections 12 and 13 the more the CI value of the fundamental wave is increased, and thereby the CI value ratio is also increased.

[0015]   In contrast, the longer the length (d1) of the excitation electrodes 12b and 13b becomes with respect to the length (L) of the vibration arm sections 12 and 13 the more the CI value of the fundamental wave is decreased, and at the same time, also, the CI value ratio approaches 1.0. For example, when the length (d1) of the excitation electrodes 12b and 13b becomes 60% of the length (L) of the vibration arm sections 12 and 13, the CI value ratio becomes 1.0 or less.

[0021]   However, if the CI value of the harmonic wave is increased to such a degree that the CI value of the fundamental wave is not increased too much, it is not easy to make CI value ratio to be 1.0 or more. Therefore, a problem inevitably arises in that the CI value of the fundamental wave is increased more than necessary.

[0035]   An object of the present invention is to provide a vibrating reed in which the ratio of CI values is maintained constant while minimizing the CI value of the fundamental wave such that variations of the CI values between the vibrating piece devices are reduced even if the base is made short, and the entire vibrating piece can be made smaller.

[0157]   As shown in Fig. 19(a), grooved portions 120a and 130a are formed on the obverse surface 120e and the rear surface 120f of the tuning-fork arm 120 (grooved-portion forming step).

Please delete the Abstract Section of the specification and replace it with the following abstract in clean form. Applicant includes herewith an Attachment for Specification Amendments showing a marked up version of the previous version of the Abstract Section.

ABSTRACT OF THE DISCLOSURE

A vibrating piece in which a CI value ratio is maintained constant while minimizing the CI value of the fundamental wave so that variations of the CI values between the vibrating piece devices are reduced even if the base is made short, and the entire vibrating piece can be made smaller.

IN THE CLAIMS

Please cancel claims 1-16. Please add the following new claims in accordance with the following rewritten claims in clean form.

17. (New) A vibrating piece comprising:

a base; and

a vibration arm section formed so as to protrude from the base, a grooved portion being formed in at least one of an obverse surface and a rear surface of said vibration arm section;

wherein a cut section is formed in said base, and

an electrode section is formed in a part of said grooved portion.

18. (New) A vibrating piece according to Claim 17, wherein:

a grooved portion is formed in at least one of the obverse surface and the rear surface of said vibration arm section; and

an electrode section is formed in a part of said grooved portion so that a crystal impedance value ratio of said vibrating piece becomes 1.0 or more.

19. (New) A vibrating piece according to Claim 18,

wherein a longitudinal length of the electrode section formed in said part of said grooved portion of said vibration arm section is approximately 45% to approximately 55% of a length of said vibration arm section.

20. (New) A vibrating piece according to Claim 17, wherein said electrode section further comprises an excitation electrode.

21.   (New) A vibrating piece according to Claim 17, wherein:

a fixation area for fixing the vibrating piece is provided in said base; and

said cut section is provided in the base between the fixation area and said vibration arm section.

22.   (New) A vibrating piece according to Claim 17, wherein said vibrating piece further comprises a tuning-fork vibrating piece formed by a crystal which oscillates at approximately 30 kHz to approximately 40 kHz.

23.   (New) A vibrator having a vibrating piece housed in a package, said vibrating piece comprising:

a base; and

a vibration arm section formed so as to protrude from the base, a grooved portion being formed in at least one of an obverse surface and a rear surface of said vibration arm section;

wherein a cut section is formed in said base; and

an electrode section is formed in a part of said grooved portion.

24.   (New) A vibrator according to Claim 23, wherein:

a grooved portion is formed in at least one of the obverse surface and the rear surface of said vibration arm section; and

an electrode section is formed in a part of said grooved portion so that a crystal impedance value ratio of said vibrating piece becomes 1.0 or more.

25.   (New) A vibrator according to Claim 24, wherein a longitudinal length of the electrode section formed in said part of said grooved portion of said vibration arm

section is approximately 45% to approximately 55% of a length of said vibration arm section.

26.   (New) A vibrator according to Claim 23, wherein said electrode section further comprises an excitation electrode.

27.   (New) A vibrator according to Claim 23, wherein:

a fixation area for fixing the vibrating piece is provided in said base; and

said cut section is provided in the base between the fixation area and said vibration arm section.

28.   (New) A vibrator according to Claim 23, wherein said vibrating piece further comprises a tuning-fork vibrating piece formed by a crystal which oscillates at approximately 30 kHz to approximately 40 kHz.

29.   (New) A vibrator according to Claim 23, wherein said package is formed in a box shape.

30.   (New) A vibrator according to Claim 23, wherein said package is formed in a cylinder shape.

31.   (New) An oscillator having a vibrating piece and an integrated circuit housed in a package, said vibrating piece comprising:

a base; and

a vibration arm section formed so as to protrude from the base,

wherein a cut section is formed in said base; and

an electrode section is formed in a part of said grooved portion.

32.   (New) An electronic device using a vibrator which is connected to a control section, said vibrator having a vibrating piece housed in a package, said vibrating piece comprising:
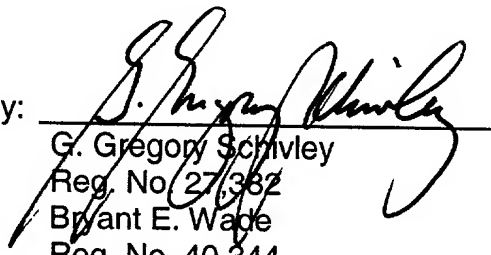
a base; and

a vibration arm section formed so as to protrude from the base;

wherein a cut section is formed in said base; and

an electrode section is formed in a part of said grooved portion.

REMARKS

The purpose of this preliminary amendment is to clarify the translation, cancel certain claims, and add new claims. Favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

Dated: _April 12, 2002_

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ATTACHMENT FOR SPECIFICATION AMENDMENTS

The following is a marked up version of each replacement paragraph and/or section of the specification in which underlines indicates insertions and brackets indicate deletions.

[0011]   Therefore, as a method of preventing such a situation, there is a method [of designing by] using a CI value ratio as a reference. This CI value ratio is such that the CI value of a harmonic wave is divided by the CI value of a fundamental wave (CI value of harmonic wave/CI value of fundamental wave).

[0013]   In order to make the CI value ratio [to be] 1.0 or more in the manner described above, it is necessary to make the CI value of the harmonic wave greater. As a method therefor, it is known that the length (d1) of the excitation electrodes 12b and 13b formed in the grooves 12a and 13a is made to be half, i.e., 0.5L, with respect to the length (L) of the vibration arm sections 12 and 13 in Fig. 11.

[0014]   Fig. 13 shows the relationship between the CI value of the fundamental wave, such as the above, and the CI value ratio. As shown in Fig. 13, the shorter the length (d1) of the excitation electrodes 12b and 13b becomes with respect to the length (L) of the vibration arm sections 12 and 13 [becomes,] the more the CI value of the fundamental wave is increased, and thereby the CI value ratio is also increased.

[0015]   In contrast, the longer the length (d1) of the excitation electrodes 12b and 13b becomes with respect to the length (L) of the vibration arm sections 12 and 13 [becomes,] the more the CI value of the fundamental wave is decreased, and at the

same time, also, the CI value ratio approaches 1.0. For example, when the length (d1) of the excitation electrodes 12b and 13b becomes 60% of the length (L) of the vibration arm sections 12 and 13, the CI value ratio becomes 1.0 or less.

[0021]   However, if the CI value of the harmonic wave is increased to such a degree that the CI value of the fundamental wave is not increased too much, it is not easy to make [that the] CI value ratio [is made] to be 1.0 or more. Therefore, a problem inevitably arises in that the CI value of the fundamental wave is increased more than necessary.

[0035]   An object of the present invention is to provide a vibrating reed in which the ratio of CI values is maintained constant while minimizing the CI value of the fundamental wave[,] such that variations of the CI values between the vibrating piece devices are reduced even if the base is made short, and the entire vibrating piece can be made smaller.

[0157]   As shown in Fig. 19(a), grooved portions 120a and 130a are formed on the obverse surface 120e and the rear surface 120f [20f] of the tuning-fork arm 120 (grooved-portion forming step).